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The Merest *Logomachy*: The 1868 Norwich Discussion of Aphasia by Hughlings Jackson and Broca.

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“No subject of late years has so occupied the attention of physiologists in all parts of the world, as the attempt to localise the grand attribute of humanity, the faculty of speech”
(Bateman, 1870, 178)

Abstract

This paper reconsiders the events which took place at the 1868 meeting of the British Association for the Advancement of Science (BA) in Norwich. Paul Broca and John Hughlings Jackson were invited to speak on the new and controversial subject of aphasia. Over the ensuing decades, there have been repeated references made to a debate between Broca and Jackson. This meeting has been identified as a turning point in favour of Broca's position on the cerebral localisation of language. A return to original sources from key witnesses reveals that the opinion of the British practitioners was generally against Broca's views. Close examination of contemporaneous materials suggests that no public debate between Jackson and Broca occurred. However, the public discussion after Broca's presentation records notable concerns over both theoretical issues of localization of function and the status of exceptional clinical cases. A significant stage in the development of current views on the organization of language in the brain is revealed in the accounts of the BA meeting in August 1868 and successive responses to these events in the British press

over a period of years.

Introduction

In an interesting Editorial which appeared in *Brain* (1999) on “Gradients in the Brain” Albert Gjedde made the statement “The Dax-Broca doctrine [sic] was not generally accepted and was actively opposed by Hughlings Jackson [in the mid 1860s]. Yet, at the historic session of the British Association for the Advancement of Science in Norwich in 1868, Broca enjoyed the enthusiastic support of the audience.” (Gjedde, 1999, 2013). An earlier consideration of this event was offered by Joynt (1982). The title of his article was “The Great Confrontation: The meeting between Broca and Jackson in 1868.” This choice of the word “confrontation” was perhaps meant to be ironic, as Joynt’s conclusion was “that the confrontation did not take place in the public forum. Perhaps, in the corridors...? We will never know.” (Joynt, 1982, 101).

The participation by Broca and Jackson at the 38th annual meeting of the British Association for the Advancement of Science (BA) held at Norwich in August 1868 represents a seminal episode in the history of aphasiology. The merits of Broca’s views on the clinico-pathological correlations of language function were being actively discussed throughout the world at this time. The young Hughlings Jackson had taken a quite different approach to the clinical manifestations of “loss of speech” (Jackson, 1864; 1866; Lorch, 2004). The fact that Broca and Jackson were brought together at a large public meeting to discuss the topic of aphasia seems to have been an event of great import. The record of this meeting provides a window on to the crucial topic of the day—the localization of function in the brain. This paper returns to the original witnesses who recorded this fascinating event. The object is to

construct the British response in 1868 to Broca's views on the localization of articulate language to the 3rd frontal convolution in the left hemisphere.

Background

The idea of specific cerebral localisations of physiological functions was brought forcefully to the scientific world by Paul Broca in a speech to the Society for Anthropology in Paris in 1861. This is not to say that the idea that specific parts of the brain served particular functions was not entertained earlier in the 19th century. Typically, however, the relation between an area of the brain and mental faculties was hypothesized without any direct evidence of the lesion site as determined by autopsy to link to the observed clinical impairments. There was a long-established research program, instituted by Gall in the early 19th century and pursued by Bouillaud for several decades subsequently, to demonstrate the relation between the anterior lobes and language functions. Bouillaud had collected a large case series demonstrating these associations several decades before Broca gave his speech (Critchley, 1965).

Broca, being the founder of the Society for Anthropology (1859), was speaking to an assuredly receptive group. However, there was something in Broca's speech that encapsulated a new approach and established an important principle which galvanized opinion in the scientific community. It caught the imagination of the audience present that evening, and was seen as significant to those interested in brain function throughout the western medical world for ensuing generations. The paper, published in the *Bulletin de Société d'Anthropologie de Paris* (Broca, 1861) and followed up by several others that year, was cited throughout Europe and North America.

Wozniak (1992) offers this explanation of Broca's success:

“While neither the conception of a faculty of articulate language nor even the notion of its localization in the anterior portion of the brain were especially novel in 1861, what Broca provided was a research finding that galvanized scientific opinion on the localization hypothesis. The detail of Broca's account, the fact that he had gone specifically in search of evidence for the patients' speech loss rather than employing cases post hoc as support for localization, his use of the pathological rather than the craniological method, his focus on the convolutional topography of the cerebral hemispheres, and, perhaps most importantly, the fact that the time was ripe for such a demonstration, all contributed to the instantaneous sensation created by Broca's findings.” (Wozniak, 1992)

There is no evidence of anyone in the UK publicly commenting on the ideas of Broca and other French colleagues on the localization of the language faculty until 1864.

In London, a young physician interested in “nervous diseases” had just begun to formulate his own ideas on neuroanatomy (Jackson, 1863). John Hughlings Jackson held junior appointments at the London Hospital and the newly founded National Hospital for Paralysis and Epilepsy in Queen Square. Greenblatt (1970) has investigated in detail the effect Broca's ideas had on Jackson at this time. The role of Charles-Edouard Brown-Séquard (who also had an appointment at Queen Square) as a conduit of ideas between Broca in Paris and Jackson in London is suggested by Koehler (1996). It remains an open question why no one in Great Britain appears to have been aware of their French colleagues' interest in this topic until three years after the initial discussions in Paris. This point is more puzzling considering that Broca's other medical and anthropological research was cited in the British literature throughout this period.

In the period between 1864, when his first paper on “loss of speech” appeared, and 1868, Jackson published over 50 papers. Of these, over a dozen were on aphasia, and this topic was a secondary theme in his first major lecture series at the London

Hospital in 1864 (Lorch, 2004). Two years later, Jackson makes a direct comment on a development in his views on how language is organized in the brain:

“I must here say that I believe less in some of the views propounded by Broca than I did, although I think the scientific world is under vast obligation to him for giving precision to an important inquiry.... I think, then, that the so-called ‘faculty’ of language has no existence, and that disease near the corpus striatum produces defect of expression (by words, writing, signs, etc.), to a great extent, because this is the way out from the hemisphere to organs which the will can set in motion.” (Jackson, 1866, 659)

The ideas of Broca and Jackson were considered side by side in the British medical press at this time. Fox’s comment is typical: “No one can study Broca’s views, nor the very excellent papers which Dr Hughlings Jackson has written on the subject, without acknowledging that there is considerable evidence in favour of the seat of the faculty of articulate speech being located in the posterior portion of the third frontal convolution...” (Fox, 1866)

This is a short review of the background leading up to the events in 1868 with respect to the main protagonists. There are larger contextual issues which are also significant when considering the differences represented by French and British clinicians grappling with the issue of the psycho-physical functions and their organization. The political climate in France to some extent had an effect on the reception of Broca’s work in both neurology and anthropology (Schiller, 1992). With respect to issues about mental function, there was a strong tradition in France of faculty psychology which was not as significant in Britain. At the time, the brain was conceived of as having only sensory-motor functions. In the obituary of Jackson which appeared in the British Medical Journal (1911) there is an attempt to remind readers of the general theoretical assumptions which were then current at this early stage in Jackson’s career:

“It is not easy for us, to whom as Schorstein said ‘the idea of brain localization is as much a matter of course as the circulation of the blood’ to realize the confusion and uncertainty which existed in 1864, when the only doctrine of cerebral localization was embodied in the fantastic tenets of the phrenologists as handed down by Gall and Spurzheim. In 1864 Dr. Hughlings Jackson, in this Journal and in the London Hospital Reports, recorded a series of cases of aphasia occurring coincidentally with right hemiplegia.” (Anon., 1911)

It should be noted that a major transformation in the understanding of cortical localization of function occurred shortly after the events in 1868 which are the focus of this paper. The demonstrations of cortical control of motor function by Fritsch and Hitzig in 1870 and by Ferrier in 1873 had a major impact on ideas about the role of specific areas of the brain having specific functions (Finger, 1994, Greenblatt, 1997). In addition, the popular status of phrenological studies was somewhat different in France as compare to Great Britain (Cooter, 1984). The religious issues surrounding the status of human qualities traditionally considered to be in the domain of the soul were beginning to be challenged by Darwin’s work on evolution. These ideas also had quite different receptions in the two countries (Harrington, 1987). The first explicit connection between aphasia, brain localization and evolutionary theory in the British literature was made by Frederick Bateman, an important figure in this period discussed below, in his book *Darwinism as tested by language* which appeared in 1877 (Radick, 2000).

The BA Meeting of 1868.

How did it come to pass that Broca and Jackson should be invited to the BA meeting?

The most likely source for this idea was the Norwich doctor Frederick Bateman. He had been trained in Paris where he became acquainted with Broca and was deeply interested in the topic of aphasia with regards its possible localization in the brain.

Bateman had already published his own paper on aphasia in 1865. In the introduction to his case study Bateman states “as the pathology of this affection is at the present time the subject of much discussion in the scientific world, I am induced to record the following case...as tending to confirm the doctrine, now attempted to be established, that aphasia is due to a lesion of some portion of the *left* hemisphere.” (Bateman 1865, 532) He included a short history of the topic and stated that he thought Broca’s work to be “the *ne plus ultra* of pathological topography.” Bateman goes on, “the question of localization of speech is just now the subject of warm discussion in the French Academy of Medicine, I have consulted various authors within my reach, and I find that the most conflicting evidence has been adduced with the view of connecting the faculty of articulated language with the various portions of the nervous centres.” (Bateman, 1865, 533)

Bateman recounted the evidence put forward by numerous French, German and Dutch authors (e.g., Andral, Romberg, and Schroeder van der Kolk). Of the English authors Bateman does cite, Hughlings Jackson is singled out as having studied 40 cases at the Hospital for Epilepsy and Paralysis with loss of speech and hemiplegia on the right side and only one with hemiplegia on the left. Bateman concluded his 1865 paper with the complaint that there was less interest in the subject in Britain and urged English clinicians to put on record pathological observations of aphasic cases to help settle the “*quæstiones vexatæ* of the day.”

The opportunity for Bateman to help resolve this issue came a few years later when he was on the local organizing committee for the 38th annual meeting of the British Association for the Advancement of Science which was to be held in his home town of Norwich in 1868. In the Wellcome History of Medicine Library London archives

there is an unaddressed letter signed by Paul Broca dated 20th April 1868 accepting an invitation to attend the BA meeting. In this letter he modestly declines to present a paper because of his poor English.

Sir,

I have received a fortnight ago your honoured letter, with the kind invitation of doctor Bateman. It is long since I wish to go to the meeting of the British Association. The duties of my double employment in the hospitals and in the School of Medicine have hitherto opposed this desire; but this year the holydays of the School of Medicin will begin on the 15th of August, instead of the 1st of 7^{ber}

It is very probable that I will obtain a leave from the hospital, and then I will be free to go and assist to the meeting of the British Association at Norwich. I had the pleasur, a few days ago, to see doct. Bateman in Paris, and I told him that I will be happy to be his guest. He invited me to communicate a paper to the Meeting, but, having learnt english exclusively in the books, I should be unable to read intelligibly an english paper, and I think that a french paper should not be received.

*Be so good, my dear sir, as to agree the sentiments of esteem to your devoted servant,
P Broca*

As can be seen from this transcription, the English is quite fluent though not flawless. Broca did in fact overcome his reservations about presenting a paper in English. He not only attended and presented, but also took a quite active part in the discussion of papers in his own and other sections throughout the weeklong meeting.

The BA meetings were significant cultural events in the English calendar and were advertised and reported on in the English newspapers and magazines of the day (as now). In the announcement of the BA meeting in the *Times* newspaper, 17 scientists were singled out as notable among the foreign visitors attending the BA including Dr Broca of Paris and Dr Vogt the neuroanatomist from Geneva.

The medical press also expressed interest in the upcoming meeting which had Broca and Jackson on the programme. The Edinburgh Medical Journal said that the BA meeting

“...promises to be one of the most brilliant in the annuals of the Association.... A large number of foreigners have intimated their intention of taking part in the proceedings amongst whom we notice the names of two of the most eminent Professors of the Faculty of Medicine of Paris—Drs Béhier and Broca, ...Prof Broca will have an opportunity of defending his views as to the localization of the faculty of speech, as the subject will be introduced for discussion by Dr Hughlings Jackson of London.” (July 1868, 95-96)

The BA Meeting convened on Wednesday 19th August with the presidential address to an audience of over 2,000 people. The programme for Monday 24th August, Section D of the Biology Department of Anatomy and Physiology lists “On the Physiology of Language, founded on Facts supplied by Cases of Diseases of the Brain” by Dr H Jackson. The abstract of this paper was apparently handed out on the day. No abstract was included in the published Transactions of the meeting. A short version appeared in the Medical Times and Gazette, and the British Medical Journal, reprinted in Brain in 1915 by Henry Head. A fuller version only appeared in the Medical Press and Circular. I have been fortunate to find a copy of the original twelve page “Abstract” of Jackson’s presentation at Norwich at the George Henry Lewes Collection at Dr William’s Library, University of London signed “With the Author’s kind regards.” This paper, being of historical significance, is reproduced here in full in the appendix.

This paper reflects an important stage in the development of Jackson’s thinking on the clinical phenomenology of aphasia. As is revealed clearly for the first time in Jackson’s 1868 talk in Norwich, there is significant emphasis placed on the variability

of patients' speech productions. An additional innovation is Jackson's attempt to delineate two types of disorder based on the severity of impairment in speech production.

Broca's paper "On the Seat of the Faculty of Articulate Language" was given the next day, Tuesday 25th August. Broca's abstract was also not included in the meeting's Transactions. All that was recorded in the Transactions was the title. Interestingly, Broca's title was non-chronologically but alphabetically listed before Jackson's. The other papers listed next were those by Prof. George Rolleston's paper title "On sixteen Eskimo Crania" and the abstract for Edward B. Tylor's paper on "Remarks on Language and Mythology as Departments of Biological Science". (Transactions of the BAAS, 1868, 120).

An editorial in the *Lancet* presented précis of Broca's presentation:

"Two facts [Broca] noticed: one was that when speech was gone by aphasia, there was always some lesion in the brain; sometimes there were conditions that leave no trace of disease in the brain, but this does leave some; the other fact was that this alteration or lesion was almost always in the left hemisphere of the brain. He thought at first it was always on the left side, but it is now known to occur in the right side, perhaps once in fifty cases. It is therefore exceptional. A third fact was that the lesion of the brain involved almost invariably part of the third convolution. He had given numerous proofs of it; first the traumatic, wherein he and others had observed the destruction of this part of the brain, and language was destroyed. This class of cases was more demonstrable than that from disease. He had seen three cases of traumatic injury on the right side, and speech continued till death. Traumatic cases therefore prove that the left, and not the right, side affects speech, when the part described is involved. Of pathological cases the lesion is almost constant on the left side; exceptions are very rare, and are of two kinds. Sometimes the lesion is on the right side, and sometimes it is neither on the right nor left, but *very near* to the third convolution on the left. He had seen it in the groove near the third convolution. In summing up, he stated that the seat of articulate language is at the posterior part of the third convolution; this convolution of the right and the left side possesses the same function; but why aphasia was produced by lesion on the left side, and not on the right, was a question still unsolved." (Aug 29, *Lancet*, 1868, 293)

On September 5, 1868, the British Medical Journal carried a long report on the presentations by Jackson and Broca at the Norwich meeting. (There was a third presenter, Dr. Robert Dunn, whose contribution will not be dealt with here.) Broca was said to have “presented his paper with demonstrations of his points by means of a diagram and plaster of Paris casts. Broca argued for the corpus striatum ‘as merely the medium of connexion.’ Prof. Broca further proposed the adoption of more precise terminology for expressing the various forms of defective speech. The words he suggested were: alogia, loss of speech from defective intelligence; amnesia, from defective memory of words; aphemia, from a defect in the special faculty of language; and alalia, from a defective articulation.” (BMJ 1868, Sept 5.)

It appears that Broca overcame his concern about his English, not only presenting this paper, but also in participating in the discussion of other presentations on that Tuesday. Commenting on Dr Rolleston’s paper “On sixteen Eskimo Crania” Broca offered the opinion that “the dolicholcephalic characters were not always well marked in Eskimo skulls.” (Lancet 29 Aug 1868, 293) Dr. Crisp gave a paper on comparative anatomy on the Tuesday, after those on aphasia, entitled “On the Intestinal Canal and other Viscera of the Gorilla”. In discussion of Crisp’s paper, “Broca stated that all birds perch on the right leg, whereupon Dr Crisp replied that this behaviour was only confined to *Grallae* and attributed it to their large liver.” (Bateman, 1870, 165fn)

Not only did Broca take an active part in discussions throughout the week long BA meeting, in addition, he presented a second paper and actively contributed to the parallel meeting being held in Norwich at the same time, the International Congress of Prehistoric Archaeology. Alfred Russell Wallace comments on this presentation:

‘Professor Paul Broca says (in a paper read before the Congress of Pre-historic Archaeology in 1868) --"The great capacity of the brain, the development of the frontal region, the fine elliptical form of the anterior part of the profile of the skull [of the cave men of Les Eyzies], are incontestable characteristics of superiority, such as we are accustomed to meet with in civilised races..." (Wallace, 1870, p)

By 1868, Broca’s interests appear to be much more focused on prehistoric skulls than the pathology of aphasia. He published a number of papers on archaeology during this period. Interestingly, the ideas Broca presented on aphasia at the BA meeting did not get published until the following year, and were printed in a newly-founded and short-lived professional newspaper called *La Tribune Médicale*. Broca did not refer to Jackson’s views in his aphasia paper of 1869.

The Public Discussion

In the Transactions of the meeting, after the listing of Broca’s presentation, there is only the note that “a discussion which included Jackson’s paper followed”. The BMJ reporter mentions that a summary of Jackson’s paper was given that day but not who presented it: “The summary of Jackson’s paper remarked on his stress on the role of the corpus striatum for intellectual expression and his disagreement with Moxon’s idea that the education of the right hand was what caused the left hemisphere to be the leading one” (BMJ, Sept 5 1868).

What is of great interest is what was said, and by whom, during the discussion after Broca’s paper. How were these comments received by the audience? What was the editorial view of the event? A fairly clear summary of the leading discussants remarks was recorded in the Lancet meeting report (Aug 29, 1868):

Bateman: “had collected 75 cases of aphasia, 27 with autopsies. In 13 there were lesions elsewhere than the anterior lobes; in 5 none at all. There were 22 against and only 5 in favour of Professor Broca’s theory.”

Hughes Bennett: “expressed the belief that the left side of the brain received more blood than the right, which might possibly explain why the left side exerted such an influence upon the faculty of speech.”

Gibb: “thought it worthy of mention, that in a number of cases of functional aphonia he had found the left side of the larynx at fault...to the extent of 75 per cent.”

Humphry: “was opposed to the localisation of organs in the brain; he was in favour of unity, and the structure of the brain favoured that view. He confessed he was prejudiced against the theory of Professor Broca.”

The Lancet Editor’s summary comment was that “it must be stated that Professor Broca, in reply, combated with great ability the objections to his theory, and explained away the cases referred to by Dr. Bateman.... The subject is still open to further investigation.” Lancet 29 Aug 1868, 293) Additional documentation of the discussion is provided in the report carried in the BMJ on September 5, 1868:

Thompson Dickson: “supported Broca but extended the localisation to in and near the third frontal convolution.”

Crisp: “argued for habit as determining the right rather than left side.”

Broca: “strongly maintained his argument of an original organic force.”

“The discussion was very spirited; Profs. Béhier, Vogt and Heynsius taking part in it.”

The two reports give a clear indication of who participated in this discussion and made major contributions.

Another commentary on the discussion appeared in the BMJ 10 days later. The overall impression at the end of the day was that “...it was absolutely impossible to arrive at any conclusion.” (BMJ Sept 15, 1868) A report of the discussion that took place at the meeting also appeared in the Quarterly Journal of Science (1868): “In the discussion many cases were brought forward by the various physicians present, which

tended on the whole to show that the evidence for localizing the power of articulate speech or verbification in a particular frontal convolution was not sufficiently satisfactory.” (Anon. QJS, 1868, 532)

While some of the commentaries expressed concerns regarding the general principle of localization of function, others focused on the lack of complete consistency in the clinico-pathological correlations that had been observed. Reading the editorials and reports of the meeting published in the British medical press gives a strong impression that in the discussion of Broca’s paper many of those who commented were not persuaded by his views. The report recorded in the Quarterly Journal of Science was clear: “The subject is one which must still occupy the attention of physiologists, but the direction of opinion seems to be against M. Broca’s theory.” (Anon, 1868, 532)

The Athenæum also reported a negative verdict for Broca’s ideas:

“A discussion followed [Broca’s paper], in which Dr Jackson’s paper of Monday was included. The weight of evidence adduced appeared decidedly adverse to the hypothesis of M. Broca, that the third frontal convolution of the left side is the special seat of the faculty of articulate language. That part of the brain is frequently diseased in cases of loss of speech due to cerebral causes, but it does not appear to be the only part diseased, nor is it invariably diseased in such cases.” (Anon, Athenaeum, 1868, 374)

Bateman (1870) remarks that after Broca’s paper there was “animated debate” by Prof Hughes Bennett, Prof Humphry, Dr Crisp, Sir Duncan Gibb, Prof Carl Vogt and others. Bateman offers his impressions of the proceedings: “It must be said of this discussion *Tot homines tot sententiae*.” (‘There are as many opinions as there are men.’) (Bateman, 1870, 99fn.) In the long passage concerning the BA meeting in Bateman’s book, as in the journal reports of the meeting highlighted above, there is no mention of any contribution from Jackson. In fact, there is no reference in any of these published notices regarding Jackson’s role in the proceedings or nor any

indication that Jackson made any comments during the discussion which occurred on the day after his own presentation.

Debate between Broca and Jackson?

Taking into consideration all evidence from those witnessing the events of the BA meeting in 1868, it seems likely that Jackson was not present for Broca's paper or the discussion that followed. The final piece of evidence which suggests that Jackson did not speak at the discussion after Broca's presentation is the telling statement by Bateman which appeared in his report of February 1, 1869 to the Medical Society of London: "In his elaborate paper in...1864, Dr Hughlings-Jackson ... [states] his observations tend to confirm, generally, the views of M. Broca. In his subsequent papers, Dr Hughlings-Jackson does not repeat his assertion, and it would be extremely interesting to know whether this painstaking observer is still to be ranked among the supporters of M. Broca's views." (Bateman, 1869, 488) This statement was made by the man who had a deep interest in aphasia, was personally acquainted with Jackson, and had a direct role in arranging the programme in Norwich. By his own report in 1870, Bateman was present throughout the whole proceedings. What is suggested in this passage is that by February 1869 Bateman still did not know if Jackson had revised his opinions of Broca's theory subsequent to his published remarks in 1866.

Jackson did latterly offer what might be interpreted as an indirect response to the views Broca had presented at Norwich several times. In June 1869 (possibly in reply to Bateman's query), Jackson commented "thus my observations may be said to support M. Broca's views in the sense in which they did so in 1864." However, he

goes on to add a clarification: “But I have ceased to use the words ‘faculty’ and ‘reside’ in the arbitrary manner in which I used these terms in the article in the Reports [of the London Hospital].” (Jackson, 1869, 600) Jackson returned to the topic of aphasia repeatedly over the years. For example in his 1873 paper on the localization of movements he says:

“In friendly controversies my opponents imply (because I say that from a physiological point of view a certain defect of *articulation* is a *rudimentary* defect of *speech*, or that “loss of memory for words” is loss of sensori-*motor* processes for words) that I am not aware of the differences betwixt the two defects...Is it not likely *a priori* that the two symptoms are owing to damages of *one* series of sensori-motor processes—the damage being of sensori-motor processes respectively low and high in evolution.” (Jackson 1873/1958, 2, 83-4.)

Broca did not refer to Jackson’s 1868 presentation when he published his views in 1869, and wrote little of note on the subject in the next decade (Henderson, 1986).

Broca’s 1869 aphasia paper was rarely referred to by his colleagues. His noted publications in ensuing years were concerned primarily with his other medical, surgical and anthropological interests. Broca died in 1880.

The Lasting Effects of the BA Meeting

In terms of Jackson’s position, there was a very strong and positive editorial which appeared in the *Lancet*:

“If there be one writer more than another to whom medicine is indebted for having first drawn attention to the insufficiency of this kind of [phrenological] view, it is Dr. J. Hughlings Jackson. He it was who, in various papers in this journal (*The Lancet*, February, 1866, December, 1867, and July 20th 1868) insisted, first, that language was a very much more complicated faculty than had been assumed; and, secondly, that if a very large number of fatal cases of aphasia showed lesions about the neighbourhood of the third frontal convolution, that was as much as to say that a large proportion of those cases had lesions in the immediate surroundings of the corpora striata,--i.e., in the most important centre and meeting-place of the various fibres of the brain. A similar view was argued in the late discussion at Norwich, by Dr Hughes Bennett.” (*Lancet*, 1868, 386)

The proceedings at the BA meeting in Norwich seems to have made a significant impression on the medical community. Authors of the major textbooks of the day felt moved to include comments on their response to the presentations given Broca and Jackson at the meeting. In his textbook, Reynolds (1868) presents a recapitulation of the development of understanding of this new clinical entity of aphasia and gives Jackson's work pride of place:

"The last step in this history [of aphasia research] and one almost equal in importance to either that had preceded it, was taken by Dr Hughlings Jackson, who arrived independently at a conclusion similar to that of MM. Dax and Broca, but who went still further than either, and showed the anatomical nature of the lesion which most frequently caused aphasia, viz. plugging of the middle cerebral artery on the left side by an embolus derived from valvular disease of the heart." (Reynolds, 1868, 2, 442)

A new edition of Tanner's standard textbook *The Practice of Medicine* was published in London in 1869. In the section on 'Aphasia', Tanner refers to the meeting at Norwich the year before:

"A fair consideration of the views which have been put forward as to the seat of the faculty of articulate language serves to show, that hesitation and doubt are the fittest attitudes to assume at this crisis.... Even M. Broca, when advocating his views before the members of the British Association for the Advancement of Science in 1868, did not shed new light on the subject. He again, fully explained his theory of the localization of articulate language in the third frontal convolution of the left side, and argued for the corpus striatum as merely the medium of connexion.... At the same time, he admitted there were apparent exceptions to his rule; and he especially drew attention to cases of aphasia (or, as he still prefers to say, "aphemia") from disease of the island of Reil, with integrity of the convolution of articulate language. In these instances, however, this convolution is cut off from the corpus striatum; being thus practically destroyed, by its isolation, so far as utterance of words goes." (Tanner, 1869, I, 381-2).

It appears that Tanner was of the opinion that Broca had not said anything new with regard to the topic beyond that which had appeared in his earlier papers, which as pointed out above was not actually the case. The real sticking point for Tanner, as other discussants at the BA, appeared to be the number of exceptions to the rule of

association between left hemisphere pathology and aphasia in the mounting record of clinical cases.

Another new edition of a standard medical text appeared in the year following the Norwich meeting. This was the 5th edition of Hughes Bennett's Clinical Lectures, another discussant after Broca's paper. The review of this book which appeared in the British and Foreign Medico-Chirurgical Review (1869) includes the comment: "The subject of Aphasia, now engaging so much attention, is briefly noticed. It is the author's belief that 'all attempts to localise the faculty of speech have hitherto failed,' and that the lesion in the anterior lobe of the left cerebral hemisphere, so often met with in cases of the kind, must be regarded simply as a coincidence." (1869, 469)

Through a careful hand search of all the medical and scientific publications which reported on the proceedings of the discussion which occurred after Broca's paper at the BA in 1868 almost all of the British opinions expressed were against Broca's position regarding the localization of the language faculty. All commentary was focused on the evidence or lack thereof for a correspondence between a particular portion of the left frontal lobe and a difficulty with speech production. Cases of aphasia with left hemiplegia and cases of aphasia showing no lesion in the left anterior frontal lobe at autopsy were seen as significant counterexamples. The lack of completely consistent and reliable associations between aphasia, right hemiplegia and a lesion in the left 3rd frontal convolutions area was seen to undermine Broca's general claim by the British medical establishment at this point in time.

In this light, it is important to stress that Broca's Norwich paper as recorded in his 1869 publication did not focus on the localization issue per se, but rather, sets out a

proposal for a more refined taxonomy to classify different types of language impairment. As such, Broca was trying to focus on the patients' actual speech production to determine the nature of the mental, linguistic and motoric components of their difficulties. This was a potentially significant development for the field. However, little attention appears to have been paid to this major aspect of Broca's paper. He called for a refinement in clinical observation as well as signaling a significant development of the theoretical distinctions between speech, language, memory and thought. In the reading of the contemporaneous British neurological literature there appears little if any uptake of this proposal.

Nevertheless, the discussion at Norwich with respect to aphasia had effects which were widespread. Notice this passage in a book review by Hecker, eight years after the event, which appeared in the American scholarly journal *Catholic World*. The book being reviewed is *Lessons from Nature as Manifested in Mind and Matter* by St. George Mivart, 1876. The review states:

"The passage in this chapter to which we reluctantly take exception is the following: 'I actually heard Professor Vogt at Norwich (at the British Association meeting of 1868), in discussing certain cases of aphasia, declared before the whole physiological section: '*Je ne comprends pas la parole dans un homme qui ne parle pas*'* –a declaration which manifestly showed that he was not qualified to form, still less to express, any opinion whatever on the subject.' (Mivart 1876) Now, we are of the opinion that, rightly understood and interpreted in the light of the most recent researches, these words convey a deep and significant truth. Hecker, 1876, 11)

*[I do not understand what it means to talk about speech in a man who does not speak.]

Discussion and Conclusions

What this critical review of the original sources confirms is that at the BA meeting in August 1869 Jackson gave a paper one day, and Broca gave a paper the next.

Following on after Broca's paper, there was a discussion of the general topic of aphasia with participation by leading members of the British scientific community. No record of Jackson's contributions to this discussion has been found. Reports and editorials which appeared in the British press subsequently represent a general consensus that Broca's position was negatively received. The strength of criticism expressed in the discussion against his views resounded throughout the literature for some time afterwards.

There is no material evidence that Jackson was actually present for the discussion after Broca's paper, although this event has been repeatedly been referred to in the literature over the past 140 years as a debate between the two of them. Indeed, it is also not evident that Broca was present on the day before his own talk to hear Jackson's presentation. No reference to the contents of Jackson's paper is included in the reporters' summaries or in the published version of Broca's talk (1869). There is evidence that Broca was very involved in the parallel meeting of the International Congress of Prehistoric Archaeology. He is known to have given a paper there and contributed to several discussions. In fact, there is no circumstantial evidence which places Jackson and Broca together at the same time in the same place during their visits to Norwich.

This reconstruction of events tells a quite different story to that which began to appear in the 20th century in histories of aphasia. Head (1920) reports the events as follows: "In 1868, the BAAS held its Annual Meeting at Norwich, and M. Broca opened a

discussion on aphasia. He was followed [sic] by Hughlings Jackson.... It is no wonder that at that period and under those conditions, Jackson's views produced little serious effect. Broca is clear, definite and precise..." (Head, 1920, 394-5) To be fair to Head as a historian, the *Lancet* August 29, 1868 did unfortunately somewhat ambiguously state "The discussion of the physiology of language, by Dr. Jackson and Professor Broca, is too large and important a matter to be dealt with here; but on a future occasion we shall give an analysis of Dr Jackson's paper, and of the debate which followed." p 286. This passage may be the source of Head's misconstruing of events. Later, Head states "As far back as 1868, when Jackson [sic] took part in the discussion on Broca's paper at the Norwich meeting of the British Association, he recognised the law that a destructive lesion can never be responsible for positive symptoms." (Head, 1926, 32) Most telling, with hindsight, is the perspective Head presents on what was for him fairly recent history. "But subsequent investigations [of aphasia after 1868] took no care to emulate the clinical acumen of Broca or the psychological insight of Hughlings Jackson. Bastian published his well-known paper in 1869 which had such an evil influence on the subsequent course of the discussion...by its simplicity and dogmatism [Bastian's theories] seduced the younger generation away from the difficulties and complexities of Jackson's doctrine." (Head 1920, 396) This statement is somewhat difficult to comprehend. In Bastian's paper (1869), there is a direct reference to Jackson's Norwich presentation. The only comment Bastian makes of it is that the division made by Jackson between Class 1 and Class 2 types of aphasia correspond to similar distinctions drawn by Saunders (1866) and Ogle (1867). From the viewing point of the 21st century, little can be seen of the lasting effects of Bastian's 1869 paper. Indeed, decades later Bastian tried to argue the priority of his (1869) model over Wernicke (1874) but was unsuccessful.

In Kurt Goldstein's biographical article on Broca in Haymaker's *Founders of Neurology* (1953) there is another reference to the event: "At the now historic session of the BAAS held in Norwich in 1868, the enthusiastic support of his [Broca's] view by the audience, coupled with their indifference to Jackson's part in the discussion, was a personal triumph for Broca, and from that time his basic idea dominated research...[and was] considered to be established beyond doubt." (Goldstein, 1953, 260) This representation is at odds with all of the original source material reviewed here. The audience did not appear to have received Broca's views positively. Goldstein's reference to the audience's so-called "indifference to Jackson's part" is puzzling. No comment on Jackson's paper was recorded to have been made during the discussion. Goldstein's remark is also surprising given the warmth of the editorials quoted above from the *Lancet* and the *BMJ* on the merits of Jackson's paper.

Goldstein's (1953) interpretation of the event can be seen to persist in the comments made by Young (1970) who has made a detailed study of the particular question of ideas on brain and language in this period. Surprisingly, Young simply repeats Goldstein's version of events but does not offer any new insights on the event:

"Jackson and Broca are reputed to have clashed publicly over their respective views of aphasia at a meeting of the British Association in 1868. Broca is said to have carried the day. (Haymaker, 1953, pp. 260-1.) Broca opened the discussion on the physiology of speech and was followed by Jackson. There is no record of their discussion in the *Proceedings of the British Association*. Broca's paper was published and contains no reference to Jackson's views. ...A synopsis of Jackson's argument appeared, but it conveys little sense of the conflict between their views. (Young, 1970, 206fn)

More recently, Schulte's (1994) biographical note on Jackson includes these observations: "In 1868 Broca presented his views in a meeting of the British Association in Norwich. Jackson contributed to the discussion [sic] and from the abstract 'Observations on the physiology of language' (1868) it is clear that Jackson opposed Broca." (Schulte, 1994, 139) There is, in fact, no reference to Broca in the extended abstract included here of Jackson's paper which is the most complete version of his presentation. In fact, there is no material evidence that Jackson directly discussed the divergent points in his and Broca's points of view at this time. More cautious retelling of the events at Norwich can be found in Schiller's (1992) biography of Broca and the Crichleys' (1998) biography of Jackson.

Although it does not appear that the Norwich meeting was indeed a "personal triumph" for Broca as far as the British audience was concerned, it is true that in the ensuing years Broca's view on the cortical localization of language did come to represent the received view and was certainly well established by the time of his death twelve years later. On the other hand, Jackson, who continued to write on "affections of speech" almost until his death in 1911, figured less and less frequently in the retelling of aphasia history as the 20th century progressed despite Head's best efforts. The majority of textbooks now include references almost exclusively to the ideas of Broca (1861) and Wernicke (1874) in chapters on aphasia. Jackson's work is cited rarely, and only appears in more detailed discussions of theoretical issues (e.g., Goodglass, 1993).

Recently, the question of Broca's aphasia and Broca's area have been reassessed (Grodzinsky and Amunts, 2006; Dronkers et al. 2007). However, what the Editor of the Lancet observed in 1868 remains true of the discussions on this topic today:

"The Norwich discussion raises once again the question of the intimate physiological nature of that curious cerebral change which produces the disease known under the various names of aphasia, aphemia, alalia, and a dozen other designations. There has seldom been, in the history of medical polemics, a more singularly tangled controversy than this. Perhaps it was natural that a dispute on the nature of speech should involve more of those confusions which depend upon mere differences in words; at any rate, there has rarely been a controversy with so much of the merest *logomachy* in it as that on aphasia." Lancet, September 19, 1868 p 386

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Abstract of a Paper
 "On the Physiology of Language"
 by J. Hughlings Jackson, M.D., F.R.C.P.

Norwich: Printed by Jarrold and Sons, London and Exchange Streets.

Defects of Language nearly always occur with a certain form of paralysis on one side, called Hemiplegia, and the right is usually the side paralysed.

Hemiplegia is paralysis of those muscles which can move independently of those of the other side; i.e. of certain muscles of the face, tongue, arm, and leg—not of the muscles which act bilaterally. Or in the technical terms—

It is a paralysis of the muscles engaged in chief voluntary operations. The bilateral muscles used in all (physically) involuntary, semi-involuntary, reflex, automatic, &c., processes escape.*

This kind of paralysis depends on damage to the *very highest parts of the motor tract*, viz., the corpus striatum, or thalamus opticus. (In cases complicated with Defects of Language usually, probably always, the corpus striatum.) In other words it shows loss of function of a motor centre, which is *embedded in the cerebral hemisphere*; or, to speak metaphorically, which *lies close upon Mind*. In loose language, the corpus striatum is the "way out" from the chief organ of Mind—through series of centres—to muscles which serve in intellectual and voluntary actions.

Damage to the hemisphere near the corpus striatum produces those defects which have been called Aphasia, Alalia, Aphemia, Aphrasia, Asphrasis, Aphthenxis, defects of Intellectual Language, Cerebral Loss of Speech, &c.

TWO KINDS OF LANGUAGE.

Healthy Language is of two inseparable yet distinct forms:

- I. Intellectual—i.e., The power to convey Propositions.
- II. Emotional—i.e., The ability to exhibit states of Feeling.

The two are separated by disease. It is Intellectual Language alone which suffers in most of the cases to be described. Emotional Language usually escapes altogether.

Intellectual language suffers *throughout*—not only in its most striking manifestation in

- (a) words, but in
- (b) writing, and
- (c) sign-making.

It is the power of intellectual expression by "movements" of any kind which is impaired—those most special, as of speech, suffering most; those of simple sign-making least, or not at all.

Emotional Language is conserved *throughout*, not only in its most striking manifestations by

- (a) Variations of voice but in
- (b) Smiles, &c. and in its most simple manifestation by
- (c) Gesticulation.

Although thus circumscribed by the term Defects of Intellectual Language, there are within this limit many varieties of defects met with in actual experience.

It is easiest to say what they are *not*.

- (1) *They are not defects of Voice.*

* It is pointed out later in the paper that the fact that the unilateral muscles of one side only suffer when part of one of the corpora striata is destroyed, does not imply that the bilateral muscles (or the centre or centres for rudimentary bilateral) movements are not represented in the corpora striata.—This is an exposition of Broadbent's Hypothesis. "*An Attempt to remove the Difficulties attending the application of Dr. Carpenter's Theory of Function of the Sensorimotor Ganglia to the common form of Hemiplegia*," by W. H. Broadbent, M.D. *Med. Chir. Review*, April 1866.

The patient who cannot say anything will vary the tone of his stock phrase or jargon and may be able to sing.

(2) *They are not defects due to mere paralysis of the tongue and other articulatory muscles.*

Nevertheless the defect may be when most rudimentary a disorder of articulation (Ataxy); but this differs very widely from paralytic articulation.

The tongue is not paralysed even when the patient may not be able to put it out voluntarily.

(3) *They are not owing to any fault in the outward organs of reception.* The patients are not deaf mutes. Speech *has been lost* suddenly after being fully acquired.

THE SPECIAL NATURE OF THE DEFECTS OF INTELLECTUAL LANGUAGE

The author arranges the cases he has to mention for convenience of exposition in two classes. In the first class the Author supposes that the sensori-motor processes for Speech are more or less *destroyed*; in the second that they are *unstable*.

Class I.

Severe cases *in which the patient is speechless or nearly so or in which speech is very much damaged.* In the worst of these cases the patient can only utter some one unvarying word or two words, or some jargon.

He relates several cases varying in severity. In these cases power to read write, and make simple signs is impaired, but the facts bearing on reading, writing and sign-making in the cases related will be more conveniently considered after Class II.

Class II.

Cases in which there are plentiful movements but wrong movements, or *plenty of words but mistakes in words.*

Under Class II. he points out that taking the phenomena of many cases, we find evidences of damage to sensori-motor processes, higher or lower in evolution according to

- (a) Complexity of movements.
- (b) Width of interrelation.
- (c) Number of associations

From ataxy of the grosser movements of articulation to an "ataxy" of movements embodying ideas. He is obliged, however, to speak of sounds, taking it for granted that in the following phenomena (1), (2), (3), &c., the disorder is of evolutions of movement and sensation in the triply-compound ascent just mentioned.

- (1) Ataxy of articulation—often an unintelligible gabble.
- (2) Alterations of words, as "sift" for "stiff."
- (3) Alterations of syllables, as "gippen" for "pigeon."
- (4) Mistakes in words—recognisable symbols—
 - (a) Related more or less in general idea, as "dinner" for "breakfast," "smell" for "taste."
 - (b) Related in sound, as "Dustman" for "Busman."
 - (c) No traceable relation, as "Where is the wind?" for "Where is the ink?"
- (5) Mistakes in compound symbols.
 - (a) Related clearly in idea—"What am I to say it is o'clock?" for "What day of the month am I to put down?" or (b) obscurely related, as "When the *warm water* comes all the *weather* will go away!" for "When the sun comes all the fog will go away."

When the defect is of processes so high in complexity, (interrelation and association) there is usually a traceable similarity, although it may be vague and deformed, betwixt the phrase used and the one intended.

- (6) Probably such defects as the following are of processes higher still, "Light the fire up there" for "Light the gas."

He then considers very generally, and with regard to all varieties of cases, the defects in complementary modes of intercommunication which accompany defects of speech, and takes the opportunity of considering a question asked, "*What is the degree of intelligence*

these patients have:" He expressly guards himself against any implication that language and thought exist separately. The question is not How is general mind damaged? but What aspect of mind is damaged?

He considers the mental condition of patients Classes I. and II. as regards—

- (a) Sign-making—simple.
- (b) Writing.
- (c) Ability to understand what is said to them.
- (d) Ability to repeat words said to them.
- (e) Reading.
- (f) Ability to play games.
- (g) Counting.
- (h) Music.

(a) *Sign-making* is least affected, sometimes seeming to escape altogether. He urges that we should distinguish in degree betwixt power to make simple signs which idiots can make, and the elaborate signs—saying nothing of finger language—which people make who are healthy, except for congenital deafness, and that we should observe if the patients can make signs to signify abstract quality as "blackness."

(b) *Writing*. This suffers more or less in nearly every case of defect of speech from disease of the hemisphere, but varies as much as the defect of speech itself does. Indeed, writing, and we may add reading, is the same defect in another form. For in each we have to reproduce the motor symbols of the words. Written or printed symbols are *symbols of symbols*.

The patient may (1) not write at all; may (2) scrawl; (3) make pothooks; (4) write bits of words; (5) may write plenty of words, but omit words and spell badly.

The patient who cannot write can usually *copy* writing correctly.

Patients can often sign their own names without copy when they cannot or will not write anything else.

(c). Do the patients know what is said to them?

It is usually held that "aphasic persons" do. The author thinks they usually do when they are speechless except for some unvarying jargon, *i.e.*, cases in Class I., but that when—cases in Class II.—they have free but disorderly utterance so high as mistakes in words they often do not understand, *i.e.* quickly understand words said to them.

(d). *Can the patients repeat words said to them?*

They cannot in Class I.; in Class II. they can, with or without blunders.

The author supposes the reason in (c) and (d) to be:

That in Class I., the sensori-motor arrangements for speech are destroyed in their lowest processes by limited disease near to, and involving the corpus-striatum. The sensory aspect of the sensori-motor processes of mind is not reached. It is the "way out" which is broken up.

That in Class II., the sensori-motor processes are impaired but not destroyed, and that the change is not limited to the region of the corpus-striatum, but reaches deeper in the brain.

(e) *They cannot read, but they can—often at least—understand what is read to them.*

(f) & (g) *These points are very cursorily considered.*

EDUCATED MOVEMENTS.

The movements of Speech are educated movements and thus differ widely from those movements which may be said to be nearly perfect at birth, such as those for respiration, smiling, swallowing, &c. All the muscles represented in the corpus-striatum unilaterally require a long education, and the most special of these are those engaged in the movements of speech, and next those of the arm. The muscles (see p. 3) always acting bilaterally, and chiefly represented bilaterally in the corpora-striata, are born with their centres for movement nearly perfect. Thus then the term*

* It is true that the tongue acts bilaterally, and that it is represented on both sides of the brain. But still it differs from other muscles acting bilaterally in that each of its sides has a distinct representation in its corresponding (opposite) side of the brain.—See Broadbent's paper, *Med. Chir. Rev.*, April, 1866, p. 479.

"Intellectual Language" merges in the larger term "Special movements acquired by the Individual," and the term "Emotional" Language in the term "Inherited Movements," (common to the Race.) There is a still more fundamental distinction.

THE MOST GENERAL NATURE OF THE DEFECTS.

The author first considers Class I. Here the words previously used give way to terms larger still. In its highest or worst form it is a loss of voluntary power with conservation of involuntary capability.

(a). The author first illustrates by the case of gross movements, e.g., a speechless patient may be unable to put his tongue out, although it moves well in reflex, &c., processes.

He next shews that there is a corresponding difference even in quasi-mental movements. "Speechless" patients sometimes ejaculate involuntarily.

Here again, taking into consideration the phenomena of many cases, it will be seen that there is, so to speak, an ascent in "compound degree" from utterances, like the common explosive oath, most generally related to general external circumstances, to actual propositions specially related to special external circumstances, i.e., until the difference betwixt voluntary and involuntary utterances is effaced.

(b). It will be found that some of those patients who cannot talk voluntarily can swear. They utter other ejaculations which are of the same category—meaningless for the expression of ideas about things although useful as vehicles for the exhibition of feelings. They swear or ejaculate when excited and cannot repeat the words of the interjectional utterance when they try.

(c). Next he instances (sic) ejaculations were appropriate to the circumstances under which they are uttered, and which are a step higher in speciality.

(d). Next, and highest, a man usually utterly speechless may get out an actual proposition.

The above-mentioned series of phenomena shew, the Author thinks, that there are sensori-motor processes for words somewhere, though usually the "will" cannot get at them.

This somewhere can scarcely be on the left side of the brain, for damage of this side has made the man speechless. These involuntary utterances are, the Author supposes, the result of action of the right side. In other words, he thinks, that the left is the leading side, and the right the automatic.

THE WILL

He then tries to shew the relation of the so-called "will" to the rest of the sensori-motor processes, and this time takes his illustrations from the stock-words or phrases which the patients always use. First, he points out that it is probable that the stock phrase was the leading sensori-motor process, when the brain was suddenly damaged, and speaks of two cases in illustration. A man becomes speechless after hard work at making a catalogue, and can afterwards say only, "List complete." (Recorded by Dr. Russell, of Birmingham.) Another man receives a wound in the left hemisphere in a brawl, and can only say, "I want protection."

He then speaks of Spencer's views on the "will," and as he believes in accordance with those views, calls the "will" the leading sensori-motor process of the moment—there being no such separation as Will and Mind.

THE LEFT SIDE OF THE BRAIN THE LEADING SIDE, THE RIGHT THE AUTOMATIC.

The Author does not think as Dr. Moxon does, that the left side of the brain only is educated, but that both are educated. It is certain that damage to the right side of the brain produces no defect of speech in most cases, and equally certain the author thinks that the disease of the left side only does not prevent the patient getting out words when a forcible circumstance outside himself is in very special relation with the processes for those words. For he points out that although there is in cases of involuntary ejaculation no prompting by the will of the patient so to speak, the

occasional utterances are developed with more or less appropriateness to then external circumstances.

Although the cerebral hemisphere are twins, the left may, if we accept Gratiolet's* statement, be said to be the first born. It is born with the lead, and thus a patients who has damage to the left side of his brain, cannot initiate movements on the undamaged right side, either objectively as in talking, or subjectively as in reading. The Author has recorded a case of Loss of Intellectual Language in a patient who was left-handed, but states that in other cases this explanation will not apply, and he admits that there are cases of Defect of Intellectual Expression with left hemiplegia which cannot be explained. Some of the patients, however, have been previously paralysed of (sic) the right side—although perhaps without any accompanying defect of speech. Still he has never seen a case of disease of the right hemisphere only as proved post mortem with defect of speech of any kind, but has recorded three cases in which this side of the brain (including Broca's convolution) was diseased without defect of speech. And all are agreed that when hemiplegia occurs with loss of speech, the hemiplegia is nearly always of the right side. He has, however, received reports of two cases—one recorded by Dr. Long Fox, of Bristol, and one by Dr. Pye Smith, in which the Broca's region (on the left) was diseased without loss of speech.

LOCALIZATION

The Author does not attempt to localize Language in any limited spot. The object is to find in mind the Latitude and Longitude of the Defect, and in brain the corresponding Latitude and Longitude of the damage,—the corpus striatum being the Greenwich.

Destruction of parts of the hemisphere at a distance from the motor tract need produce no obvious mental symptoms of any kind. AN equivalent quantity of destruction of parts near the [left] corpus striatum will, however, cause defects of intellectual expression. He thinks that the quantity of defect depends generally on the (1) quantity of destruction of tissue, and (2) on its nearness to the highest part of the motor tract, (the corpus striatum,) "the point of emission of the orders of the 'will' to the muscles." (The Author here quotes Mr. Dunn, who has long held essentially similar opinions).

He next proceeds to shew that there is a more special kind of localization. He believes the principle of localization is essentially the same as that given by Spencer. Taking the corpus striatum and optic thalamus as the illustration, the Author speaks of the "localization of the limbs." He thinks the facts supplied by an observation of many cases of damage to these bodies show—

- (1) That both the arm and leg are represented throughout these bodies.
- (2) That there is an order of representation according to the "intelligence" of parts. The arm is more represented than the leg, the hand than the arm, the thumb and first finger than the rest of the hand.
- (3) That there is also a representation of Speciality, there being localities where even the less intelligent parts have the leading representations.

Or, putting the above in another way. He thinks that pathology shews the corpus striatum to be made up of Physiological Units—this term he takes from Spencer—each representing potentially the whole of the limb. Yet that these are not repetitions of exactly similar units, but that each unit superintends a different movement of the whole limb.

* Gratiolet's observations show not only that the *frontal* convolutions (the convolutions specially related to the corpus striatum, which is a centre *chiefly* motor) of the left side are developed in advance of those on the right, but that the *sphenoidal* and *occipital* convolutions (the convolutions specially related to the thalamus opticus which is a centre *chiefly* sensory) are in advance of those of the left. May we not suppose that the right is the leading side, and the left the automatic side for "educated sensations?" Such "crossed action" of the brain would be in accordance with the crossed action in the spinal cord which Brown-Séquard's researches have established, and is in accordance also with the law of the orderly distribution of motor and sensory nerves laid down by Hilton and Schroeder van der Kolk.

So admitting that speech resides in each part of the brain, he supposes that there are points—probably in Broca's convolution—where the most immediate processes for talking are specially represented, and that there will be others near the corpus striatum where other acquired "faculties"—for instance, the movements of the arm for playing the violin, &c., &c., are specially represented, but that there is no localization in the sense that one part superintends one thing and no other.

The corpus-striatum represents, to use arbitrary terms, the highest physical evolution of movements for articulation, for the arm and for the leg: from this point start the psychical movements of speech.

It is thus interesting to inquire if there be not starting from the corpus-striatum a traceable evolution of movements for the educated psychical movements of the limbs. The author believes the phenomena of certain nervous diseases shew disorder of the most rudimentary of these processes.